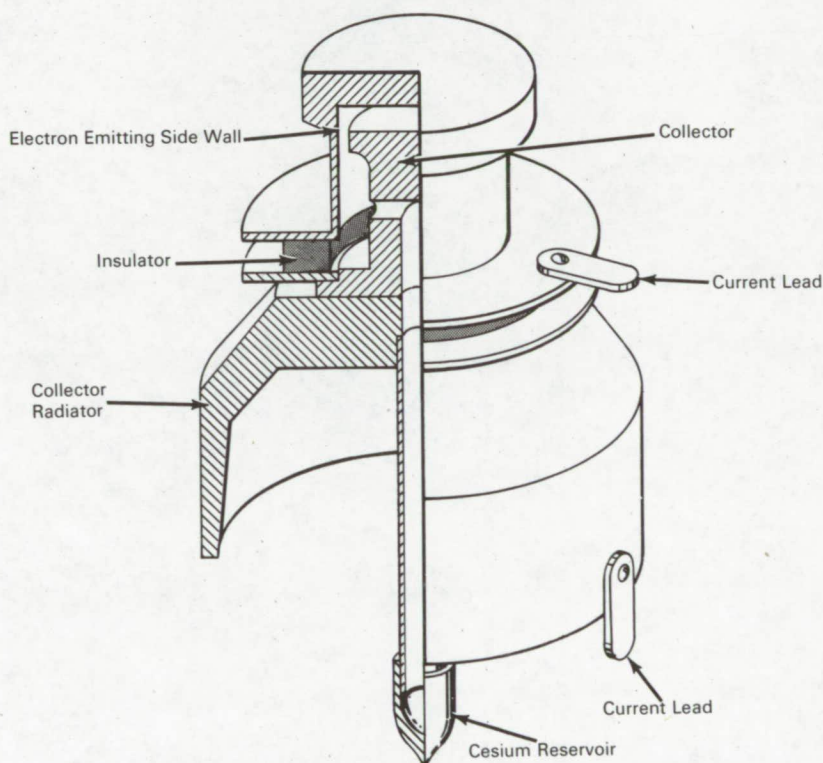


NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U.S. space program, to encourage their commercial application. Copies are available to the public at 15 cents each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

Thermionic Diode Switching Has High Temperature Applications



The problem:

Solid-state switches are currently being used to "chop" the output from low-voltage/high-current power sources. Temperature limitations and radiation damage susceptibility of semiconductor switches severely limit their application to high temperature or radioactive power source conditioning. To overcome these difficulties, the semiconductor switch must be placed in a remote location; however, excessive system degradation results from line losses.

The solution:

A thermionic diode switch that permits "chopping" in the immediate vicinity of the power source, regardless of the adverse environment.

How it's done:

When operated under low emitter temperature (1000°C) and low cesium reservoir temperature ($<200^{\circ}\text{C}$) conditions, the thermionic diode exhibits dual mode (plasma mode and unignited mode) properties of immediate application to high current

(continued overleaf)

switching. In this temperature regime, the thermionic diode has lost its power generation capability; however, it has developed characteristics required of a current switch. In what has been referred to as the plasma mode, the thermionic diode will pass current densities in excess of 12 amp/cm² with a forward voltage drop less than 0.6 volts. When the diode is switched out of the plasma mode into the conventional unignited mode, voltages up to 4.0 volts may exist across the diode with only milliamperes of current flowing through it. Thus, by placing a thermionic diode in series with a low-voltage (<4.0 volts)/high-current power source, the output of the source may be chopped by alternately pulsing the thermionic diode switch into the plasma and extinguish modes. The attached figure shows the diode geometry successfully tested.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B67-10672

Patent status:

No patent action is contemplated by NASA.

Source: Katsunori Shimada and Scott S. Luebbers
of Jet Propulsion Laboratory
(NPO-10404)